No.: 10/620,430

REMARKS

The indication of allowable subject matter in claim 5 is acknowledged and appreciated. In view of the following remarks, it is respectfully submitted that all claims are in condition for allowance.

Claims 1-4, 6 and 7 stand rejected under 35 U.S.C. § 103 as being unpatentable over the articles entitled "Novel High Drain ..." authored by Masato et al. ("Masato"). Claim 1 is independent. This rejection is respectfully traversed for the following reasons.

Claim 1 recites in pertinent part, "the step of heat-treating the first semiconductor layer in an oxidizing atmosphere whose temperature is adjusted to be within a range of 950 °C or more and 1050 °C or less." The Examiner admits that Masato does not disclose or suggest the claimed temperature range and attempts to overcome this deficiency by relying on the well-known case law of *In re Aller* to allege that "discovering the optimum or workable ranges involves only routine skill in the art." However, in order to make such an allegation, **the Examiner must first establish that the optimized value (heat-treatment temperature) is a result-effective variable.**

The Examiner is directed to MPEP § 2144.05(II)(B) under the heading "Only Result-Effective Variables Can Be Optimized", which sets forth the applicable standard **when applying *In re Aller***:

> A particular parameter must first be recognized as a result-effective variable, i.e., a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation. (citing *In re Antonie*, 195 USPQ 6 (CCPA 1977)).

In the instant case, Masato is silent as to any particular effects resulting from the heat-treatment temperature and thereby fails to identify the heat-treatment temperature as a variable which achieves a recognized result. Rather, Masato merely discloses the heat-treatment temperature of 900°C ***incidentally*** as a ***conventional and known*** temperature at which the heat-treatment functionality can

be carried out. Masato does not appear to disclose any reasoning for the selection of 900°C nor suggest, explicitly or implicitly, experimentation of the heat-treatment temperature to achieve a recognized result. Accordingly, there is no motivation or rationale for modifying the heat-treatment temperature of Masato (900°C) to fall within the claimed range. Indeed, the Examiner has not asserted, let alone evidenced ***from prior art***, that the heat-treatment temperature is a result-effective variable, i.e., a variable which achieves a recognized result. Therefore, pursuant to the cited MPEP section above, optimum or workable ranges of the heat-treatment temperature can NOT be characterized as routine experimentation.

To better illustrate the substantive gap in the pending rejection, the following example is described. If, *hypothetically* assuming, Masato had disclosed that a high heat-treatment temperature improved conductivity, for example, but only disclosed 900°C as a specific example; such a scenario may better support reliance on *In re Aller* in that the recognized result of "improved conductivity" would have been disclosed by Masato with a specific example near the claimed range, whereby optimization to find the best temperature for "improved conductivity" may be considered routine experimentation.

However, in the instant case, as discussed above, Masato is silent as to any recognized result in the heat-treatment temperature, let alone suggestive that experimentation leading to temperatures in the claimed range would optimize such a result. Only Applicants have recognized and considered the heat-treatment temperature as a result-effective variable, and conceived of a novel temperature range to achieve results discovered only by Applicants. The Examiner is directed to page 8, lines 11-24 of Applicants' specification, which discloses:

> the contact resistances of the ohmic electrodes on the AlGaN layer 12 were measured after the heat treatment. As a result, it was confirmed that the contact resistance values were decreased to about a fifth of corresponding contact resistances obtained before the heat treatment. **From this, it is found that the heat treatment**

> **performed at about 1000°C caused the silicon in the oxidation protection film 13 to have diffused into the surface portion of the AlGaN layer 12, but not into its portion near the interface with the GaN layer 11**.
>
> It should be noted that the temperature of the heat treatment is not limited to about 1000°C, but may be any temperature within a range of 950°C or more and 1050°C or less. **A heat treatment temperature smaller than 950°C results in a decrease in the amount of silicon diffused, in which case the effect of reducing the contact resistance cannot be obtained sufficiently**. On the other hand, in the case of a heat treatment temperature higher than 1050°C, the oxidation protection film 13 melts to degrade the shapes of the surface structure and insulating film 14 of the semiconductor multilayer structure.

As evidenced by the emphasized portion above, a heat-treatment temperature below 950°C does not achieve the effects discovered exclusively by Applicants. **Indeed, the heat-treatment temperature of Masato of 900°C is merely cumulative to the admitted prior art discussed on page 3, lines 1-9 of Applicants' specification**, which describes a "known HFET fabrication method [where] the selective oxidation process is performed in the oxygen atmosphere at a temperature of about 900°C, [whereby] the oxidation treatment needs to be carried out for more than [at least] 4 hours in order to form an isolating insulator film having a sufficient thickness for device isolation." Indeed, Applicants' specification makes several direct comparisons between the claimed heat-treatment temperature and the conventional heat-treatment temperature of 900°C disclosed by Masato.

For example, page 13, lines 3-4 of Applicants' specification discloses "heat oxidation carried out at 950°C [enables] the contact resistance value [to be] reduced to about half as compared to the conventional heat treatment at 900°C"; page 11, line 23 – page 12, line 1 of Applicants' specification describes a heat treatment within the claimed range "enables the isolating insulator film 39, having a sufficient thickness for device isolation, to be formed in a period of time which is about one-fourth to one-fifth of that of the conventional heat treatment performed at 900°C"; etc..

The present invention enables preventing "silicon diffusion from the protection film ... from extending below the first semiconductor layer, which allows an isolating insulator film to be formed through the heat treatment in a short time without degrading electric characteristics of the semiconductor device; [and] setting the heat treatment temperature within the [claimed] range ... [can] ensure that silicon diffuses into the surface of the first semiconductor layer, thereby enabling a decrease in the contact resistance of the semiconductor device" (*see* page 4, lines 5-11 of Applicants' specification).

Accordingly, it is respectfully submitted that, as admitted by the Examiner, Masato does not disclose the claimed temperature range, and further, the cited prior art does not provide the requisite suggestion to modify the disclosed heat-treatment temperature of 900°C. Indeed, Applicants' admitted prior art described on page 3 of Applicants' specification teaches away from modifying Masato in that 900°C is disclosed as the conventional heat-treatment temperature. Only Applicants have conceived of the necessary temperature range to obtain the dual-effects of reducing contact resistance while maintaining the shapes of the surface structure and insulating film of the semiconductor. In the shown exemplary embodiment, for example, "[t]his not only permits the insulating film 14 for device isolation to be formed in a short time, but also allows silicon to be diffused from the oxidation protection film 13 into the surface portion of the AlGaN layer 12, thereby achieving the desired electric characteristics" (*see* page 10, lines 6-13 of Applicants' specification).

The Examiner is directed to MPEP § 2143.03 under the section entitled "All Claim Limitations Must Be Taught or Suggested", which sets forth the applicable standard:

> To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. (citing *In re Royka*, 180 USPQ 580 (CCPA 1974)).

In the instant case, the pending rejection does not "establish *prima facie* obviousness of [the] claimed invention" as recited in claim 1 because the cited prior art fails the "all the claim limitations" standard required under § 103.

Under Federal Circuit guidelines, a dependent claim is nonobvious if the independent claim upon which it depends is allowable because all the limitations of the independent claim are contained in the dependent claims, *Hartness International Inc. v. Simplimatic Engineering Co.*, 819F.2d at 1100, 1108 (Fed. Cir. 1987). Accordingly, as claim 1 is patentable for the reasons set forth above, it is respectfully submitted that all claims dependent thereon are also patentable. In addition, it is respectfully submitted that the dependent claims are patentable based on their own merits by adding novel and non-obvious features to the combination.

Based on the foregoing, it is respectfully submitted that all pending claims are patentable over the cited prior art. Accordingly, it is respectfully requested that the rejection under 35 U.S.C. § 103 be withdrawn.

CONCLUSION

Having fully and completely responded to the Office Action, Applicants submit that all of the claims are now in condition for allowance, an indication of which is respectfully solicited. If there are any outstanding issues that might be resolved by an interview or an Examiner's amendment, the Examiner is requested to call Applicants' attorney at the telephone number shown below.

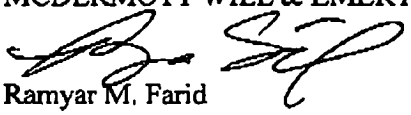
To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including

No.: 10/620,430

extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

MCDERMOTT WILL & EMERY LLP



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